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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,108	08/24/2004	Charles Steven Korman	147903-1	5107

6147 7590 03/18/2010

GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
ONE RESEARCH CIRCLE
PATENT DOCKET RM. BLDG. K1-4A59
NISKAYUNA, NY 12309

EXAMINER	
TRINH, THANH TRUC	
ART UNIT	**PAPER NUMBER**
1795	

NOTIFICATION DATE	DELIVERY MODE
03/18/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/711,108	KORMAN, CHARLES STEVEN	
	Examiner	Art Unit	
	THANH-TRUC TRINH	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 April 2009 and 15 December 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. In view of the appeal brief filed on 12/15/2009, PROSECUTION IS HEREBY REOPENED. A new ground of rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) initiate a new appeal by filing a notice of appeal under 37 CFR 41.31 followed by an appeal brief under 37 CFR 41.37. The previously paid notice of appeal fee and appeal brief fee can be applied to the new appeal. If, however, the appeal fees set forth in 37 CFR 41.20 have been increased since they were previously paid, then appellant must pay the difference between the increased fees and the amount previously paid.

A Supervisory Patent Examiner (SPE) has approved of reopening prosecution by signing below:

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 1795

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1-3, 7-12, 15-17 and 21-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cole (US Patent 6008449) in view of Gee et al. (US Patent 5951786), and further in view of either Stein et al. (US Patent 5071491) or Hollaus et al. (US Patent 4567316).

Regarding claims 1 and 15, as seen in figures 1-5, Cole discloses a solar cell assembly comprising:

- a plurality of solar cells (see solar cells 22, 22a, 22b, etc... in any of the figures) each having a first side (e.g. the side facing the light) and a second side (e.g. the side opposite to the light), and each of the plurality of solar cells configured to produce an electrical current when receiving

photons on at least the first side (e.g. a solar cell is a device that produces an electrical current when receiving photons on at least the firs side);

- an encapsulant (see upper support 28 of reflective member in figure 5) operably coupled to the first side (e.g. the side facing incoming light) of each of the plurality of solar cells;
- an insulative substrate (see lower support 26 of reflective member in figure 5; col. 4 lines 50-53, claims 13 and 34) operably coupled to the second side (e.g. the side opposite to the first side, or the bottom side of substrate 68) of the solar cells;
- a metal foil (or reflective layer 48) having a first surface (e.g. bottom surface facing the layer 26 as in figure 5) bonded to the insulative substrate (e.g. 26) and a second surface (e.g. top surface facing the encapsulant 28 in figure 5) including an interconnect pattern for electrically interconnecting a plurality of solar cells in a series string (see figures 1-5 and col. 7 lines 58-62). The second surface of the metal foil includes a light reflector (e.g. v-shaped patterns) disposed at exposed regions on the second surface, wherein the light reflector is configured to reflect light incident thereon to increase a concentration of light on the solar cell. (See Figures 1, 3-5, and 7)

While Cole teaches the metal foil (48) bonding to the substrate (68) of each of the solar cell (22) as seen in figure 5 (or the back side of the solar cell), the reference

does not specifically show the second surface of the metal foil including in electrical contact with pads in figure 5.

Gee et al. teaches a metal foil (see electrical conductive circuit element 7 in figures 3-4, paragraph bridging col. 5 and col. 6) for electrically interconnecting a plurality of solar cells (see solar cell 10) in a series string (see figures 1 and 3-4), wherein the metal foil 7 has a surface facing the light (see the surface of element 7 facing glass cover 15) in electrical contact with pads (see terminals 13 corresponding to p-type and n-type current collection grids of the cells, paragraph bridging cols. 5 and 6) located on the same side of each solar cells (see figures 3 and 4). It would have been obvious to one skilled in the art at the time the invention was made to have had the second surface of the metal foil (e.g. 48) including an interconnect pattern of Cole in electrical contact with pads located on the same side of each solar cells as taught by Gee et al., because Gee et al. teaches that the pads (or terminals 13) connecting with the electrical conductors in order to create an electrical circuit capable of generating power (see col. 7 lines 29-44) and using the pads (or terminals 13, or back contacts) would obviate the necessity for tabs to overlay the collecting surface of the cells, enable manufacturers to arrange cells more closely together within the cell grid, and avoid the difficult automation and high stress points associated with front-to-back lead attachment (e.g. pads or contacts on different sides of solar cells) and allow for planar processes that permit all of the cells in a photovoltaic module to be electrically connected in a single step (see col. 2 lines 60-67).

Cole also does not specifically teach including an edge connector and a bypass diode so that the electrical current from each solar cell in the series string is transported from the pads and combined at an edge connector, and series string is bypassed in case of failure of the series string.

Stein et al. teaches connecting a plurality of solar cells (e.g. 1 as seen in Figure 1) to form a series string, wherein the electrical current from each solar cell in the series string is transported to the conductive frame parts 2 and 3 which act as positive and negative electrical terminals (See Figure 1). Therefore the conductive frame parts 2 and 3 are the edge connector. Stein et al. also teaches integrating a bypass diode into the solar cell equipment or into the frame (See col. 3 line 67 through col. 4 line 4). Similarly, Hollaus et al. teaches connecting a plurality of solar cells to form a series string (see Figures 1-2 and 3a-b), wherein the electrical current from each solar cell in the series is transported to the edge connector such as conductor 7 (see Figures 1-2) or conductor ribbon 20 at the edge of the solar module 5 (see Figures 3a-b). Hollaus et al. also teaches including bypass diode (e.g. 4 in Figures 1-2; 41-45 in Figures 3a-b) to prevent voltage reversal (See col. 2 lines 10-20). It would have been obvious to one skilled in the art at the time the invention was made to modify the solar cells assembly of modified Cole by including edge connectors and bypass diode as taught by either Stein et al. or Hollaus et al., because both Stein et al. and Hollaus et al. teach the edge connector is used to connect a plurality of rows of solar cells into a string within a limited space (See Figure 1 of Stein et al., Figures 1-2 and 3a-b of Hollaus et al.) and the bypass diode is

required to prevent failure of the series string (e.g. heating, voltage reversal, see col. 1 lines 63-65 of Stein et al., col. 1 lines 10-20 of Hollaus et al.)

Regarding claims 2-3 and 16-17, modified Cole teaches the substrate (26) is made of acrylic decal (see col. 5 lines 23-26 of Cole). Therefore the substrate comprises a flexible polymeric substrate.

Regarding claims 7 and 21, modified Cole teaches the metal foil (or metallic reflective layer 48) is made of electrically conductive metal (see col. 5 lines 54-56 and col. 9 lines 22-67 of Cole). Coles also teaches the material used is low cost (See col. 3 line 54 through col. 4 line 44). Therefore the metal foil is a conductive metal foil selected on a basis of cost, electrical and thermal performance.

Regarding claims 8 and 22, modified Cole teaches the metal foil (or metallic reflective layer 48) is electrically conductive and bonded directly to the substrate of the solar cells at a bond site 72b. (See Figure 5 and col. 9 lines 22-46 of Cole). Therefore the metal foil (or metallic reflective layer 48) is patterned to match at least an interconnection configuration of the solar cell and a PV laminate module.

Regarding claims 9-12 and 23-26, mofified Cole teaches the metal foil (or metallic reflective layer 48) is made of metal and electrically conductive (see col. 5 lines 54-56 and col. 9 lines 22-67 of Cole). Therefore the metal foil (or metallic reflective layer 48) is configured to provide a low resistance interconnection of a plurality of solar cells while providing a thermal sink for heat generated by each cell, the heat generated by at least one of the solar cells and absorbed solar radiation internal to the module is

channeled to an edge defining module via the metal foil, and the edge defining module is configured to dissipate the generated heat by one of radiation and convection. In other words, the metal foil of Cole (or metallic reflective layer 48) functions as an electrical conductor, thermal conductor, and an optical reflector.

5. Claims 4-6, 13, 18-20 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cole (US Patent 6008449) in view of Gee et al. (US Patent 5951786) and further in view of either Stein et al. (US Patent 5071491) or Hollaus et al. (US Patent 4567316) as applied to claims 1-3, 7-12, 15-17 and 21-26 above, and further in view of Epstein (US 2003/0058553).

Regarding claims 4-6, 13, 18-20 and 27, modified Cole discloses a photovoltaic assembly as set forth above

Modified Cole does not teach coating the metal foil (24) with a reflective coating such as reflective ink of colloidal of glass spheres in an optical transparent binder.

Epstein teaches a light directing film (or for reflecting light) having metal coating film (130 in Figure 3, 230 in Figure 5) on a patterned surface (114 in Figure 3, 214 in Figure 5), wherein the metal coating film is overlain by a layer (135 in Figure 3 and 235 in Figure 5) of glass beads in polymethyl-methacryalate(136 in Figure 3 and 236 in Figure 5). (See paragraphs 0101-0107 and 0112-0118). It is the Examiner's position that polymethyl-methacrylate is an optical transparent binder.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the assembly of modified Cole by coating the metal layer

(or metal foil 24) with a reflective ink of glass beads (or colloidal suspension of glass spheres) in polymethyl-methacrylate (or optically transparent binder) as taught by Epstein, because Epstein teaches that the glass beads in polymehtyl-methacrylate layer would improve the performance and durability of the reflective metal coating (see paragraphs 0083-0088). In addition, because both the references are concerning with reflecting light, one would have reasonable expectation of success from the combination.

6. Claims 14 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cole (US Patent 6008449) in view of Gee et al. (US Patent 5951786) and further in view of either Stein et al. or Hollaus et al. as applied to claims 1-3, 7-12, 15-17 and 21-26, and further in view of Glenn (US Patent 6313396)

Regarding claims 14 and 28, modified Cole teaches a photovoltaic assembly as set forth above.

Modified Cole does not teach the substrate includes a plurality of metallized vias to allow dissipation of heat therethrough.

Glenn teaches a photovoltaic assembly having a substrate (18, Figures 1, 3A-B, 4-5) with vias (or openings 22 as seen in Figure 22) filled with metal (conducting element 17 – See Figures 1, 3A-B, 4-5; col. 4 line 10 through col. 6 line 44). Therefore the substrate includes a plurality of metallized vias to allow dissipation of heat therethrough.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the assembly of modified Cole to include a plurality of metallized vias to allow dissipation of heat therethrough as taught by Glenn, because Glenn teaches the photovoltaic assembly with such substrate is lightweight and inexpensive to manufacture. (See col. 8 lines 63-67 of Glenn).

Response to Arguments

7. Applicant's arguments with respect to claims 1-28 have been considered but are moot in view of the new ground(s) of rejection.

Applicant argues that none of the references teaches the limitation "the first surface of the metal foil is bonded to an insulative substrate and the second surface of the metal foil includes an interconnect pattern in electrical contact with pads located on a same side of each solar cell for electrical interconnecting a plurality of solar cells in a series string" as recited in claims 1 and 15. The Examiner replies that Cole discloses the first surface of the metal foil (or the surface facing layer 26 in figure 5) bonded to the insulative substrate (see layer 26 in figure 5 of Cole) and a second surface (e.g. surface facing layer 28 as seen in figure 5) including an interconnect pattern for electrically interconnecting a plurality of solar cells in a series strings. Gee et al. teaches a metal foil (see electrical conductive circuit element 7 in figures 3-4, paragraph bridging col. 5 and col. 6) for electrically interconnecting a plurality of solar cells (see solar cell 10) in a series string (see figures 1 and 3-4), wherein the metal foil 7 has a surface facing the light (see the surface of element 7 facing glass cover 15) in electrical contact with pads

(see terminals 13 corresponding to p-type and n-type current collection grids of the cells, paragraph bridging cols. 5 and 6) located on the same side of each solar cells (see figures 3 and 4). It would have been obvious to one skilled in the art at the time the invention was made to have had the second surface of the metal foil (e.g. 48) including an interconnect pattern of Cole in electrical contact with pads located on the same side of each solar cells as taught by Gee et al., because Gee et al. teaches that the pads (or terminals 13) connecting with the electrical conductors in order to create an electrical circuit capable of generating power (see col. 7 lines 29-44) and using the pads (or terminals 13, or back contacts) would obviate the necessity for tabs to overlay the collecting surface of the cells, enable manufacturers to arrange cells more closely together within the cell grid, and avoid the difficult automation and high stress points associated with front-to-back lead attachment (e.g. pads or contacts on different sides of solar cells) and allow for planar processes that permit all of the cells in a photovoltaic module to be electrically connected in a single step (see col. 2 lines 60-67).

Conclusion

8. Applicant's amendment filed on 4/17/2009 necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to THANH-TRUC TRINH whose telephone number is (571)272-6594. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on 571-272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TT
3/8/2010

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 1795